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4 and 5. To change the rule requiring Latin diagnoses, to "Latin, French, English or German." The rule as adopted in Vienna is better, in our opinion, than the proposed modification.

6. To more clearly indicate valid and invalid naming of genera and higher groups. Here the committee's proposed amendments certainly make the rule more definite.

7. To provide for the disposition of the species when a genus is divided into two or more genera. Here again the committee's recommendation is much more specific than the rule in the code, and seems to provide for all the cases that may come up under it, which the original rule does not.

8. To provide for the proper retention of the original name in the division of a species. The committee's rule is much more specific and is a marked improvement upon the rule in the code.

9. To provide that priority of place upon the page shall be actual priority in the case of simultaneous publication of names. This is so reasonable that it should meet with no opposition.

10. To provide for the rejection of certain names by a more definite indication of the cases. The committee would reject "homonyms," "metonyms," "typonyms" and "hyponyms." Their statement is better than that of the code and may well be adopted by the congress.

11. To allow the specific name to be the same as the generic name, as in the familiar cases of *Taraxacum taraxacum*, *Linaria linaria*, etc. The Vienna Code requires the rejection of the specific name in such cases, in spite of the law of priority. The committee very properly regard this as "an unfortunate exception to the general law of priority."

On the whole it seems that this committee of American botanists is warranted in presenting its motions for amendments. With the exception of the fourth and fifth, relating to the diagnoses of new groups, we hope that these motions for amendments will be adopted.

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# SPECIAL ARTICLES

## A DISCUSSION OF SOME OF THE PRINCIPLES GOVERNING THE INTERPRETATION OF PRE-PER-SOONIAN NAMES, AND THEIR BEARING ON THE SELECTION OF A STARTING-POINT FOR MYCOLOGICAL NOMENCLATURE<sup>1</sup>

If there is any one fact which more than others has become increasingly evident during the last thirty years in the study of fungi it is that a thorough examination of their microscopic characters is necessary for the certain determination of most of the species. The older systematists based their species entirely upon external characters. While the spores of fungi were early observed, they were regarded as of no importance systematically, and even as late as 1849 Fries himself forcibly stated that in the whole family of Discomycetes no natural genera could be based on carpo-logical characters. In the decade between 1860 and 1870, however, influenced by the work of the Tulasne brothers and of de Bary, systematists turned their attention more seriously to the study of microscopic characters, and it at once became evident that important diagnostic marks were to be found in structures too small to be seen with the unaided eye. The great amount of careful morphological and developmental work which has been done among the fungi during the last thirty-five years has only emphasized the importance which should be attached to microscopic characters in distinguishing genera and species in this group. To such lengths has this tendency developed that in recent years whole systems of classification have been proposed based almost entirely on microscopic features, and in the eyes of all workers such characters have come to be regarded as the most important available bases for generic and specific distinction.

This method of study has frequently developed the fact that two or more plants, externally indistinguishable, really represented as many different species or even distinct genera. Illustrations of this condition are

<sup>1</sup>A paper read before the Botanical Society of America at its meeting in Baltimore, December 31, 1908.

very numerous among the Ascomycetes, and will at once occur to any one at all familiar with the fungi. A few concrete examples will perhaps put the matter in a more definite light. The genera and species of the Phycmycetes are based almost entirely on microscopic characters. Among the powdery mildews the genera *Sphærotheca* and *Erysiphe*, as well as *Podosphæra* and *Microsphæra*, can not be distinguished from each other without the use of the microscope. Most of the genera and species of the Pyrenomycetes are founded on characters drawn from the asci and spores, which can not be made out with the unaided eye. Among the Discomycetes the genus *Trichoglossum* is represented in America by about half a dozen species which are indistinguishable by their gross features. The genera *Geoglossum* and *Corynetes* can not be told apart by external characters. The same is true of *Barlæa* and *Humaria*, *Sphærospora* and *Lachnea*, and many others. In nearly all of these genera are whole groups of well marked species which are based entirely on minute microscopic characters. Specific limits among the rusts, smuts and other groups are too familiar to need mention. On the other hand, it is equally true that there are certain fungi which are so unique and well marked that they stand off by themselves, and can be much more certainly recognized by external features alone. Such species occur more commonly among the larger fleshy and woody forms, but even here minute hymenial characters are recognized as being of the greatest systematic importance. No one can venture to assert that careful students of these better marked forms may not soon discover microscopic features at present unused which may entirely upset our ideas of their specific limits. It is not necessary to dwell further on this phase of the subject, for the facts are too familiar to need elaboration. Enough has been pointed out to emphasize the fact that the number of species of fungi which may be placed with certainty on the basis of external characters alone is comparatively small.

If, therefore, the accurate determination of most of the species of fungi on the basis of gross characters alone is next to impossible

when the living plant is actually before one, how much more uncertain must be the identification of the species of older writers, which are represented by only brief descriptions of the most obvious external features, or at best by figures often crudely drawn or inaccurately colored. The simple fact is that the majority of the species of fungi described by writers before 1800 can not be recognized with certainty at the present time, when measured according to present-day standards. Yet systematic literature is filled with the references of well known fungi to names dating from Linnæus, Scopoli, Jacquin, Batsch, Bulliard, Paulet, Schaeffer, Adanson, Schrader and many others, the majority of which are at best involved in doubt. Of course it is perfectly possible for one to speculate on the probabilities in such cases, but positive conclusions can never be inferred from doubtful premises, and he will be no nearer definite knowledge at the end of his speculations. The writer firmly believes that in the field of systematic mycology a single gram of knowledge is of more value than kilos of guess-work, supposition and uncertainty, and he wishes here to raise the question and to invite discussion as to whether the time has not come to take steps to eliminate from consideration these old names, the great majority of which can never be definitely fixed.

We are thus led naturally to inquire Why should mycological nomenclature date from Linnæus's "Species Plantarum" of 1753, and thus include this mass of undeterminable names? While Linnæus had a good understanding of vascular plants the distinguishing characters of which are gross and external, his knowledge of the lower organisms, especially of algæ and fungi, was very slight. Indeed, it seems probable that very little that he wrote concerning the fungi was based on his own first-hand knowledge, but that his work with these plants consisted principally in the application of binomial designations and brief descriptions to those figured by his predecessors. The distinguished botanists of Harvard University have stated the matter so admirably that I can do no better than to quote from them as follows:

Although the year 1753 seems eminently desirable as the starting point for the nomenclature of the spermatophytes, the use of this date among the lower groups, as for instance the algæ, appears not only highly inexpedient but well-nigh farcical. Among the flowering plants both genera and species had by 1753 been interpreted with a tolerable degree of definiteness, and their descriptions were at that time drawn with sufficient understanding of morphological and diagnostic features to make them in general intelligible to future generations. On the other hand, at the date of Linnaeus's "*Species Plantarum*" the knowledge of the algæ was far too crude to form a satisfactory basis for their classification or nomenclature. Even the optical appliances necessary for the intelligent examination of this group had not been invented. What is here said of the algæ is quite as true of the fungi and applies in lesser degree even to the bryophytes and pteridophytes. Furthermore, the great difficulty or impossibility of preserving specimens in several of the lower groups, and the consequent fact that no type specimens are now extant for a large proportion of the species of the lower orders, render it all the more imperative that the beginning of nomenclature in these groups should not be carried back to a time of brief, vague and unintelligent descriptions.

In consideration of these facts it seems desirable that in the nomenclature of the spermatophytes priority should be reckoned from the publication of Linnaeus's "*Species Plantarum*" in 1753, but in the case of all other groups, from a date near 1800, to be more exactly determined by a committee of specialists in cryptogamic botany, appointed by the International Congress in whatever manner it may seem best.<sup>2</sup>

Acting with a knowledge of the facts so comprehensively stated in the quotation just given certain algologists are advocating the selection of much more recent dates as the points of departure for the nomenclature of certain groups. Why should not students of the fungi do the same; and, if any such action is to be taken, what is the most desirable date to be selected? The writer has seen only a single definite proposition bearing on the selection of such a starting-point, and ventures to offer the following suggestions in the hope that they may stimulate discussion of the matter.

<sup>2</sup> "Amendments to the Paris Code of Botanical Nomenclature," p. 13, 1904.

It may be well to point out at once some of the considerations which should have weight in the selection of a starting-point for mycological nomenclature. In the first place there should be, if possible, a common point of departure for all groups of fungi. Secondly, the date selected should be early enough to include the greatest possible number of published names. Thirdly, it should, if possible, mark the beginning of some important epoch in mycological history. Fourthly, the personage whose work is chosen should be one of the most prominent in the development of systematic mycology. Fifthly, the specific work selected should be a comprehensive one which deals with all the principal groups, which summarizes what has been done before, and which, in a word, bears about the same relation to the classification of fungi that Linnaeus's "*Species Plantarum*" does to that of the vascular plants. Sixthly, and perhaps most important, it should be the work of a person who preserved a considerable proportion of the specimens on which his publications were based, and whose collection is now available for examination, so that his names can be fixed with some degree of definiteness.

It would be too much to expect that any one work should be in all respects ideal, and it would be impossible to select one which would not be open to some objection, "but the one which in the opinion of the writer comes the nearest to fulfilling all the requirements named above is Persoon's "*Synopsis Methodica Fungorum*," published in 1801.

A brief historical sketch will make clearer the reasons for this opinion. The development of systematic mycology covers three quite distinct periods, each of which is marked by its own peculiar point of view and characteristic method of work. These may be designated as (1) the pre-Persoonian period or period of the illustrators, (2) the Persoon-Friesian period or period of the systematists, and (3) the modern period or period of the morphologists. The first period covers approximately the last three quarters of the eighteenth century, extending from about 1725 to about 1800, and as characteristic may

be cited the work done by Vaillant, Micheli, Schmidel, Schaeffer, Batsch, Holmskjöld, Bulliard, Paulet and Sowerby. These men were all essentially illustrators. In their publications the larger and more conspicuous fungi were figured with some care and usually in color. Their plates were accompanied by descriptive text which, of course, dealt only with the gross and external features of the plants discussed. In most cases names were applied to the plants illustrated. Before the time of Linnæus these were mostly descriptive polynomials, but later the binomial method of designation was employed. Although the illustrators came to group their species in several genera on the basis of the most obvious superficial resemblances, no attempts were made by any of them to perfect a systematic arrangement of the fungi which could be at all compared with those which had been worked out for the flowering plants during the same time. In only a few instances have any of the fungi illustrated in this period been preserved so that aside from the information conveyed by the descriptions and figures we have no means of determining what plants the authors had before them. The writer has already attempted to show that the majority of the species of fungi described in this period can not be recognized with certainty at the present time, when measured according to present-day standards. The information about fungi in this period was in a much more crude and unsystematized state than that which prevailed concerning the spermatophytes before the time of Linnæus. It is primarily of historical rather than scientific interest, and consequently can be left out of consideration without any resulting serious loss to scientific knowledge. Surely no logical starting-point for mycological nomenclature can be found in this archaic period.

The second period of mycological history covers approximately the first two thirds of the nineteenth century, extending from 1800 to about 1865. With the advent of Persoon a complete change came over the aspect of mycological study. The attention of workers was turned from the illustration of fungi to their classification and systematic arrangement.

The work of this strange man in his garret at Paris either directly or indirectly profoundly influenced that of such students as Wahlenberg, Fries, Schumacher, Nees von Esenbeck, Corda, Ditmar, Rabenhorst, Schweinitz, Duby, Desmazières, Leveillé, Montagne, de Notaris, Berkeley, Broome and many others who came after him, and whose names are familiar as household words to the mycologist. As the result of their labors immense numbers of new species were brought to light, their external features described, and arranged according to the then approved systems of classification. This method of work characterized the second or Persoon-Friesian period of mycological development.

While Persoon's publications before 1800 were of minor extent, yet they introduced an entirely new point of view. Persoon really originated systematic mycology. The "*Synopsis Methodica Fungorum*," of 1801, is one of the few epoch-making mycological publications. Not only was it the pioneer work of its kind, but it became the direct foundation of the Friesian system of arrangement which remained in almost universal use for half a century. While the Persoon-Friesian methods of classification are not those in use today, they were probably the best which the existing knowledge of fungi permitted, and they undoubtedly served their purpose fully as well as did the Linnæan system among the seed-plants.

Persoon's "*Synopsis*" was a comprehensive work in that all the groups of fungi known at the time were treated. It was synoptical in that its author went over the works of his predecessors, brought together the scattered descriptions, and either incorporated the names directly or arranged them as synonyms as seemed to him warranted by the evidence at his command. The "*Synopsis Methodica Fungorum*" therefore bears about the same relation to the systematic arrangement of the fungi that Linnæus's "*Species Plantarum*" does to that of the spermatophytes. The same reasons which led to the adoption of the latter as the starting-point for the nomenclature of the higher plants should cause Persoon's work to be chosen for that of the fungi.

While it is true that Persoon, and nearly all the students of fungi in this period, studied only external characters, it is equally true that Persoon and Fries and the majority of the workers of their time *preserved a considerable number of their fungi*, and their collections are now available for study. The result is that a majority of the names from Persoon down can be fixed with a degree of definiteness which is impossible for those described before his time. Objection may be raised that many of Persoon's types are missing from his herbarium; that herbarium specimens are liable to become interchanged, and that in other cases it is often difficult or impossible to determine just what his type of a particular species was. There is undoubtedly force in this argument, but it must be admitted that specimens, although sometimes confused, are the most reliable bases for determination that we have, and the same objections may be brought against any other collection, even against some of those of quite recent date.

Some mycologists, perhaps, might be willing to begin their nomenclature with Persoon, but would urge that his more mature and elaborate work, the "*Mycologia Europæa*," should be chosen as the starting-point. To the mind of the writer the principal objections to starting with this later work are: (1) That its publication extended over several years, from 1822 to 1828; (2) that it was almost exactly contemporaneous with another equally, if not more important work, the "*Systema Mycologicum*" of Fries; (3) it, therefore, does not stand out in a class by itself at the beginning of an epoch.

It has been suggested by certain students of fungi that the "*Systema Mycologicum*" of Fries should be used as the starting-point for mycological nomenclature. While the writer recognizes fully that this work is one of the most important and influential systematic mycological contributions yet produced, and that scientifically it was a great advance upon the "*Synopsis Methodica Fungorum*" of Persoon, yet he believes that no lack of appreciation of its value is shown in the conviction that it is not so natural a starting-point for

nomenclature as is Persoon's work. The following reasons may be given in support of this opinion: (1) The publication of the "*Systema*" extended over several years from 1821 to 1832, a long period of time which would, in fact, establish different starting-points for the various groups of fungi. (2) In the year of publication of each of the earlier parts appeared important works by other authors (*e. g.*, S. F. Gray, 1821; Persoon, 1822; Schweinitz, 1822; Greville, 1823), in which cases it would be difficult if not impossible to determine priority of publication. (3) It, therefore, does not stand out in a class by itself at the beginning of an epoch, but is one of a number of publications on the same subject which appeared about the same time. (4) While Fries's system of classification was much more elaborate than that of Persoon, and showed a better understanding of relationships and of the relative value of characters, it was in many, if not most, of the groups founded directly upon that in Persoon's "*Synopsis*."<sup>\*</sup> (5) Fries's species are no more capable of positive identification at the present time than are those of Persoon.

The third period in the development of mycology began in the decade between 1860 and 1870, when the second and most important change came over the aspect of the study of fungi. This movement was inaugurated by the publication of the Tulasnes' "*Selecta Fungorum Carpologia*" (1861-1865) and of de Bary's "*Morphologie und Physiologie der Pilze, Flechten und Myxomyceten*" (1866). Most of the work done before this time had consisted in the almost interminable species-making on the basis of the external and gross features of the plants examined, but from this time on the attention of students was directed to the study of the morphological details and the development of fungi, a kind of investigation which has laid the foundation for sounder systems of classification. In some respects it would be better to start the nomenclature of fungi with some important work in which the

<sup>\*</sup> For a concrete example see the present author's analysis of the relation of Fries's classification of the fleshy discomycetes to that of Persoon in *Bull. Torr. Bot. Club*, 27: 464-466, 1900.

more modern ideas of classification are made use of. There is, however, no great epoch-making work in this period which is adapted to being made such a starting-point, and, moreover, the selection of such a late date would exclude a very large proportion of the known genera and species of fungi, which had been described before the period began.

The question will naturally arise in the minds of some. Why, after all, is it necessary to fix a special date for the beginning of nomenclature of the fungi? It is manifestly impossible to adopt any starting-point which will effectually remove from consideration all the vague and uncertain names. Why not leave the matter open? Let monographers trace the history of each species and adopt the earliest name which can with certainty be applied to it, and relegate the uncertain names to the limbo of species *ignotæ*. One may reply to such objections that the whole matter is one of expediency; that while many of the names published after 1801 must always remain undeterminable on account of the absence of authentic specimens, the majority can be definitely identified because the describers preserved the specimens on which the names were based; that while some of the names published before 1801 were applied to plants so unique that they can be placed with reasonable certainty without specimens, the majority can never be accurately, or even approximately, determined for the reasons already pointed out; that as long as the way remains open attempts will be made continually (as has been done in the past) to revive these archaic names on the basis of supposition and a discussion of the probabilities in each case, a kind of reasoning which can never lead to definite conclusions, but which must always be productive of uncertainty and difference of opinion, with a consequent continued unsettled condition of the nomenclature of even the commonest fungi. For these reasons the writer believes that a special starting-point should be adopted so that a large proportion of these vague, indefinite, unintelligently characterized names which can never be definitely fixed should be effectually disposed of.

The writer would, therefore, urge the

adoption of Persoon's "*Synopsis Methodica Fungorum*," of 1801, as the starting-point for mycological nomenclature for the following reasons:

1. The names applied to fungi before the time of Persoon should be excluded from consideration for the reason that the majority of them can never be definitely and certainly identified.

2. Any publication in the modern period is too recent and exclusive, a large proportion of the systematic work with fungi having been done before it began.

3. Its date of publication is early enough to include a great majority of the published names of fungi, and nearly all of those which can be certainly fixed at the present time.

4. Its publication marks the beginning of the second important epoch in mycological history, that of the scientific study of fungi.

5. It is the first important systematic work of the founder of systematic mycology, and is therefore the logical point with which to begin the nomenclature of the subject.

6. It is a comprehensive work which can be used as well as any other as the common point of departure for all groups of fungi.

7. It is a synoptical work which summarizes what had been done before its time, so that it bears about the same relation to the classification of fungi that the "*Species Plantarum*" of Linnæus does to that of the seed-plants.

8. Persoon's herbarium is in existence and is available for study, so that a considerable proportion of his names can be fixed with a degree of definiteness which is impossible for those published before his time.

9. It possesses an advantage over the "*Systema Mycologicum*" of Fries in that it was published within the limits of a single year in which no other important work on mycology appeared, so that it stands alone in a class by itself at the beginning of an epoch.

10. The adoption of this date would remove the incentive for much guess-work and speculation on the probable identity of many of the vaguely and unintelligently described or crudely figured species of fungi, which must always remain incapable of certain identifica-

tion, and would thus contribute materially to the stability of mycological nomenclature.

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#### SOCIETIES AND ACADEMIES

##### THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 456th meeting was held March 6, 1909, with President Palmer in the chair. Dr. Theodore Gill offered some notes on oral gestation in cichlid fishes. He said that there was much to learn about the habits of American cichlids and especially about their buccal incubation. Professor Putnam as long ago as 1863, in the *Proceedings* of the Boston Society of Natural History (p. 226), remarked that "in the genus *Bagrus* [really *Arius*] Professor Wyman found that it was the male that took charge of the eggs, while in the Chromoids [*i. e.*, Cichlids] it is the female. The specimens in which this peculiar fact was noticed were presented to the Museum of Comparative Zoology by Rev. J. C. Fletcher, from the Rio Negro, and by Professor Wyman, from Surinam. In these specimens the eggs and young were found in all stages of development."

This statement has been universally overlooked and various authors, especially Lortet and Günther, maintained that it was the male that took charge of the eggs, and not till 1902 and later did Boulenger and Pellegrin demonstrate that it was always the female of Syrian and African cichlids that did so. There was much uncertainty about the American species and the genus comprising the "two species" observed by Putnam was not named. It was probably *Geophagus*.

Very recently, in an article on the "Freshwater Fishes of French Guiana" extracted from the *Revue Coloniale*, Dr. Pellegrin claimed that it was the male of the American *Geophagi* that nurses the eggs; his words are "Chez les Géophages américains c'est le mâle qui se charge ainsi des soins à donner aux œufs et aux jeunes; chez les Cichlides africains comme les Tilapies, c'est la femelle ainsi que M. Boulenger et moi l'avons montré."

It is improbable that the American species differ so decidedly from the African and the neglected half-century-old observations of Wyman and Putnam deserve resurrection. Perhaps the specimens observed are still in the Museum of Comparative Zoology and can be identified by Mr. Garman or Professor Eigenmann. Agassiz in his "Journey to Brazil" in 1865 made some

observations but did not state whether the egg-carrying individuals were females or males.

Now that much attention is being paid to the breeding habits of fishes, we may hope that definite observations will soon be made of American cichlids. Some, indeed, have been published by German aquarists which appear to show that there may be considerable difference in the habits of the species, but the information is still unsatisfactory. May this note serve to elicit more definite data.

Dr. L. O. Howard referred to the importation of the brown tail moth accompanying seedlings from France. It is a practise of American nurserymen to buy seedlings from the north of France. Thirty per cent. of a recent shipment carried the winter nests of the moth. There is no national inspection law in this country and the stock had become widely distributed before its infection was known. Much of it was later traced and destroyed under state laws. An old federal law forbids the carrying of such infected stock in vessels, and steamship companies after a warning are now more careful in this respect. A protest from the French nurserymen alleged that the brown tail moth would not thrive in our northern states, and was already common in the southern states. But the fact is that in this country the moth is a great pest in the northern states to which it is confined.

The chair referred to the reservation by executive proclamation under the Monuments Act of several regions containing objects of scientific interest. The recent creation by President Roosevelt of the Mt. Olympus National Monument in the Olympic Mountains of Washington, the home of the Roosevelt elk, is the first of its kind having a zoological as well as geological interest.

Dr. Evermann called attention to a recent act of Congress which provides for the establishment of a biological station at Fairport, Iowa. An appropriation of \$25,000 for the establishment of this station was made a year ago and recently Congress passed the item providing for the personnel. The site has been definitely selected at Fairport, Iowa, where the bureau has acquired sixty acres of land admirably suited to the purpose. About fifty acres of the land lies along the river front and is exceedingly well adapted to the construction of the necessary ponds, of which there will be several acres. Near the river front is a railroad used by two companies with a number of trains each way daily, thus affording adequate railroad facilities. Some 1,800 feet from the river front is a public highway connecting